My NASA Data - Mini Lesson/Activity

Evaluating Natural and Human Activities Effects on Earth's Climate

Grade Band

- 9-12

Time

- 30 minutes

Overview

In this mini lesson, students analyze a bar graph showing the relative forcings from natural and human factors that affect Earth's climate. They use information from this graph to assess the relative importance of these factors.

Student Directions

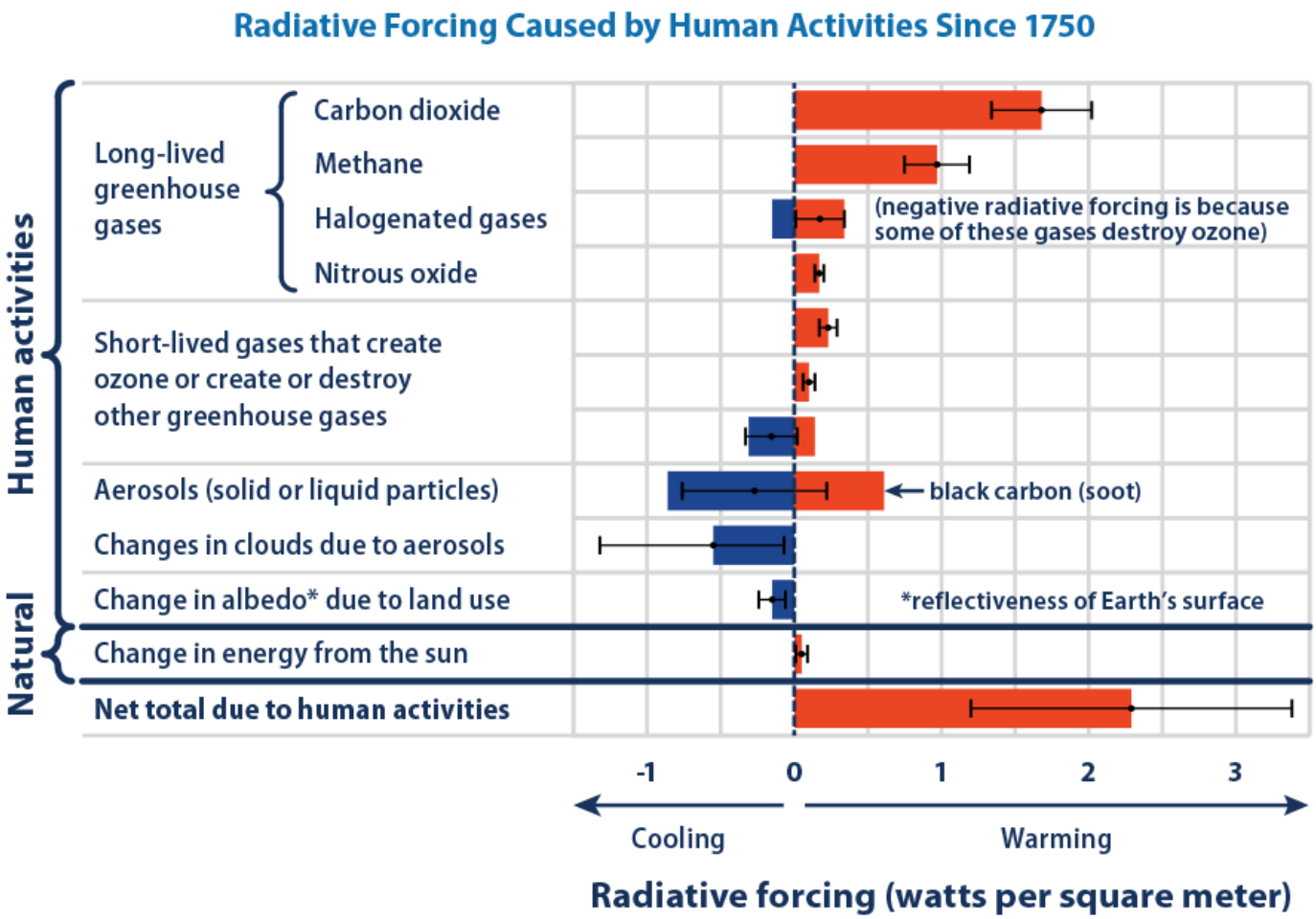
What happens when the amount of energy entering into the Earth system does not equal the amount that exits? This is a simple question with a complicated answer.

Imbalances in the Earth's Energy Budget are called **radiative forcings.** They cause chemical and physical changes in the Earth system that impact the climate. An example of this imbalance is the current trend in Earth's Energy Budget; the Earth system has more energy entering than leaving (called a "positive forcing"). Conversely, if more energy exits than enters the system, the planet would cool ("negative forcing").

Energy into Earth - Energy leaving Earth = Radiative Forcing Amount

Prior to the Industrial Revolution, the radiative forcing was nearly balanced, and Earth's atmosphere was relatively stable. Scientists use a year prior to this era, 1750, as a baseline. This baseline year is used to compare radiative forcings and measure the impact of anthropogenic activities of modern times that affect our climate. See the chart below to identify and analyze the warming or cooling

effects of these forcings. Notice that there are two main categories: anthropogenic (human-caused) and natural.



Data source: IPCC (Intergovernmental Panel onClimate Change). 2013. Climate change 2013: The physical science basis. Working Group I contribution to the IPCC Fifth Assessment Report. Cambridge, United Kingdom: Cambridge University Press. www.ipcc.ch/report/ar5/wg1.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.

[Radiative Forcing Caused by Human Activities Since 1750]
[Credit: EPA]
[https://mynasadata.larc.nasa.gov/sites/default/files/2021-10/climate-forcing-download2-2016.png]

Steps

1. Review the chart above and answer the following questions. Check with your instructor on how to submit answers.

    1. What is the net total value of radiative forcing (in watts per square meter) of natural activities? Anthropogenic (human) activities?
    2. Of the anthropogenic activities, which factor has the greatest value? What category does this belong to?
    3. Which of the factors have both a cooling and warming effect on climate?

4. Why is the year 1750 selected as a baseline?
5. What are three questions that you can ask of this chart?

Source:

1. *Climate Change Indicators: Climate Forcing* | *US EPA*. (2021, July 21). US Environmental Protection Agency. Retrieved May 13, 2022, from https://www.epa.gov/climate-indicators/climate-change-indicators-climat…

Teacher Note

Teachers, these mini lessons/student activities are perfect "warm up" tasks that can be used as a hook, bell ringer, exit slip, etc. They take less than a class period to complete. Learn more on the "My NASA Data What are Mini Lessons?" page.

Teachers who are interested in receiving the answer key, please complete the Teacher Key Request and Verification Form. We verify that requestors are teachers prior to sending access to the answer keys as we've had many students try to pass as teachers to gain access.

NGSS Three Dimensional Learning

NGSS Disciplinary Core Ideas

- ESS2A: Earth Materials and Systems
- ESS3C: Human Impacts on Earth Systems
- ESS3D: Global Climate Change

Crosscutting Concepts

- Cause and Effect
- Scale, Proportion, and Quantity
- Stability and Change

Science and Engineering Practices

- Developing and Using Models
- Analyzing and Interpreting Data

Supported Common Core Math

- CCSS.Math.Content.HSS.ID.A.1
- CCSS.Math.Content.HSS.ID.A.2
- CCSS.Math.Content.HSS.ID.A.3

Document Resources

- Radiative Forcing Caused by Human Activities Since 1750, Credit: EPA.